WINTERING WATER BIRDS AT POINT CALIMERE, TAMIL NADU [1]

V. NATARAJAN [2]

(With a text-figure)

Details of bird ringing and census studies of waterbirds carried out during the year 1985-86 at Pt. Calimere Wildlife and Bird Sanctuary, Tamil Nadu, are given. A total of 5321 birds of 38 species were ringed, predominantly little stint *Calidris minuta*, ruff and reeve *Philomachus pugnax* and curlew sandpiper *Calidris ferruginea*. 104 birds of five species were recaptured. Among these, the little stint was the maximum. Two birds (little stint and ruff) with Russian rings were recovered. The physical measurements of eight species of waders were analysed. The wing-tarsus ratio for lesser sand plover *Charadrius mongolus* reveals that the majority of the population visiting Pt. Calimere are of the *atrifrons* group. The seasonality, diversity and density of waterbirds are discussed. The bird population fluctuates in different months in relation to water level and food availability. The mean monthly bird species diversity recorded was 2.01 and the annual mean bird density (all species) was 516 birds/sq. km.

INTRODUCTION

Pt. Calimere (10°18′ N, 79°51′ E) in Tamil Nadu, with the Bay of Bengal to the east, Palk Strait to the south and salt pans and marshes on the north and west, is a major wintering waterfowl refuge in India (Ali 1963). It attracts a large number of migratory waterfowl. The Bombay Natural History Society has been ringing waterfowl and landbirds over several years at Pt. Calimere (Ali and Hussain 1981-1982). A checklist of birds both observed as well as ringed at Pt. Calimere has been published (Sugathan 1982). This paper deals with two aspects of ornithological studies at Pt. Calimere: firstly bird ringing activities, and secondly census data.

BIRD RINGING ACTIVITIES

MATERIAL AND METHODS

The present paper deals only with the waterfowl ringing and census studies during the year 1985-86. For the trapping of waterfowl, experienced trappers from a local village were employed, and used traditional methods such as hand-made meshnets, clap traps and nooses for catching birds. The birds were identified, ringed and aged according to Prater *et al.* (1977).

The physical measurements of birds were taken according to the standard techniques (Spencer 1976). After taking measurements and noting the moult status, the birds were released at the place of capture. The results of the moult study will be published elsewhere.

RESULTS AND DISCUSSION

To date, 243 species of migratory and resident birds have been recorded. The total number of birds ringed for the past six years is given in Table 1. The populations of landbirds and waterbirds fluctuate each year depending on climatic conditions and the availability of food. During eight months of ringing operations in 1985-86, 5321 waterbirds of 38 species were caught and ringed.

The little stint *Calidris minuta*, followed by ruff and reeve *Philomachus pugnax* and curlew sandpiper *Calidris ferruginea* were the commonest birds ringed in 1985-86. The monthwise totals for each species are shown in Table 2. A peak in total number of birds ringed was seen in December and the minimum number in April.

TABLE 1
YEARWISE RINGING OF BIRDS AT PT. CALIMERE

Year	Number of birds	
	Landbirds	Waterbirds
1980-81	7553	18456
1981-82	2499	9775
1982-83	3203	10259
1983-84	643	7846
1984-85	1493	7448
1985-86	1439	5321
Total	16830	59105

[1] Accepted June 1991.

[2] Bombay Natural History Society, Hornbill House, Shaheed Bhagat Singh Road, Bombay 400 023.

TABLE 2
NUMBER OF WATERBIRDS RINGED IN 1985-86 AT PT. CALIMERE (4 SEPTEMBER 1985 TO 21 APRIL 1986)

Species	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Ardeola grayii			7	9			7	4	27
Ardeola striatus							2		2
Bubulcus ibis		2	6						8
Egretta garzetta			1						1
Phoenicopterus roseus	1								1
Anas acuta				1	2		1		4
Anas crecca							1	1	2
Anas querquedula			1						1
Anas clypeata				1	3	4			8
Amaurornis phoenicurus							5	3	8
Charadrius leschenaultii				1					1
Charadrius alexandrinus				5		1	1		7
Charadrius mongolus	2	2	23	1		4		5	37
Numenius phaeopus			1						1
Numenius arquata				1				2	3
Limosa limosa				2					2
Tringa totanus	1		3	2	4	1			11
Tringa stagnatilis		7	2	31	1		8		49
Tringa nebularia			3						3
Tringa glareola		6		36			2		44
Tringa terek			1	1					2
Tringa hypoleucos							1		1
Arenaria interpres			1				1		2
Gallinago stenura							1		1
Calidris minuta	822	531	529	813	376	806	454	169	4500
Calidris alpina	1	1	3	4	4	3			16
Calidris ferruginea	44	47	22	85	6		9	3	216
Limicola falcinellus		1	10						11
Philomachus pugnax	6	7	77	194					284
Phalaropus lobatus		17	2	1					20
Recurvirostra avosetta					2				2
Larus argentatus					4	8	4		16
Larus brunnicephalus					2	3	7	1	13
Larus ridibundus						1			1
Chlidonias hybrida			4						4
Sterna hirundo	2		2						4
Sterna albifrons			4						4
Sterna bergii			4						4
All species combined	879	621	706	1188	404	831	504	188	5321

Recapture profile: In total, 104 birds of five different species were recaptured during the year. The maximum number of recaptures were of *Calidris minuta* (91) followed by *Calidris ferruginea* (6), lesser sand plover *Charadrius mongolus* (3), *Philomachus pugnax* (2) and redshank *Tringa totanus* (2) (Table 3). Four *Calidris minuta* were recaptured after five years. Two *Calidris ferruginea* were recaptured after two years and a *Philomachus pugnax* after four years. Two interesting recoveries were obtained of birds ringed elsewhere, *Calidris minuta* with Moskwa ring No.K 450382 replaced by BNHS ring No. A. 230789 on 6 March 1986, and *Philomachus pugnax* (MB 023023 replaced by B. 48807) on 26 September 1985. The ringing details obtained from Moskwa for the *Calidris minuta* show that it was ringed on 29 August 1982 in Sorbulak lake,

TABLE 3
RECAPTURE DETAILS OF WATERBIRDS AT PT. CALIMERE (1985-86)

No.	Ring No.	Date of ringing	Wt. (g)	Location	Recapture date	Wt. (g)	Location	Time interval		
								years	months	days
Calidris minuta - A (Ring size)										
1.	220392	1 Mar '85	22	Pump House-1	4 Sep '85	24	MN Bund	–	6	8
2.	206294	21 Jan '83	23	Retta Theevu	5 Sep '85	21.5	MN Bund	2	7	18
3.	206041	18 Jan '83	24	MN Bund	6 Sep '85	24	"	2	7	23
4.	220555	16 Mar '85	24	"	6 Sep '85	25	"	–	5	25
5.	199258	16 Nov '82	22	Pump House-3	7 Sep '85	24	MN Bund	2	9	27
6.	220149	21 Jan '85	24	Pump House-2	10 Sep'85	27	"	–	7	23
7.	220794	6 Sep '85	22	"	10 Sep'85	20.5	"	–	–	5
8.	220844	9 Sep '85	22	"	14 Sep'85	25	"	–	–	6
9.	213698	14 Nov'84	21	C. Plantation	14 Sep'85	24.5	"	–	10	5
10.	213452	8 Nov '84	20	C. Plantation	14 Sep'85	25	"	–	10	11
11.	182464	24 Feb '81	18	Manal Vaikal	16 Sep'85	20	"	4	6	26
12.	199945	16 Dec '82	20	Neduntheevu	17 Sep'85	22	"	2	9	7
13.	213598	10 Nov '84	21	C. Plantation	17 Sep'85	20	"	–	10	29
14.	220931	11 Sep'85	19	C. Plantation	17 Sep'85	–	"	–	–	7
15.	213302	5 Nov '84	20	Mariamman koil	24 Sep'85	20.5	Neduntheevu	–	10	24
16.	213457	8 Nov '84	23	C. Plantation	24 Sep'85	23	Neduntheevu	–	10	21
17.	213987	10 Dec'84	24	Retta Theevu	26 Sep'85	25.5	MN Bund	–	9	21
18.	220452	6 Mar '85	20	MN Bund	29 Sep'85	22	"	–	6	28
19.	196970	21 Aug'82	22	"	29 Sep'85	22	"	3	1	11
20.	169848	27 Sep'80	24	–	29 Sep'85	21.5	"	5	–	4
21.	213602	30 Nov'84	20	–	11 Oct'85	20	MN Bund	–	10	16
22.	223557	1 Oct'85	23.5	MN Bund	12 Oct'85	28	MN Bund	–	–	12
23.	205729	15 Nov'83	27	Pump House-2	14 Oct'85	23	"	1	10	29
24.	220938	12 Sep'85	25	MN Bund	17 Oct'85	23	"	–	1	6
25.	179037	12 Dec'80	23	Pump House-3	21 Oct'85	25.5	"	4	10	15
26.	206580	27 Jan'83	23	MN Bund	24 Oct'85	24.5	"	2	9	2
27.	214065	13 Dec'84	23	Kutnikkadu	26 Oct'85	22.5	"	–	10	17
28.	223325	21 Sep'85	17.5	MN Bund	26 Oct'85	21	"	–	1	6

TABLE 3 (contd.)

No.	Ring No.	Date of ringing	Wt. (g)	Location	Recapture date	Wt. (g)	Location	Time interval		
								years	months	days
29.	207488	4 Mar '85	24	Pump House-2	5 Nov'85	23	C. Plantation	2	8	8
30.	220920	11 Sep'85	24.5	MN Bund	14 Nov'85	24	Mariamman Koil	–	2	5
31.	209905	10 Oct'85	21	Neduntheevu	15 Nov'85	21	"	–	1	7
32.	223803	16 Oct'85	21	MN Bund	16 Nov'85	20	"	–	61	2
33.	193382	3 Dec'81	19	Pump House-3	16 Nov'85	19	"	3	11	20
34.	185403	23 Sep'81	24	Retta Theevu	20 Nov'85	24	Pump house-1	4	2	–
35.	203476	12 Jan'84	24.5	Mariamman koil	20 Nov'85	22	"	1	10	14
36.	220343	28 Feb'85	23	Mariamman Koil	20 Nov'85	24	"	–	8	26
37.	220309	27 Feb'85	21	MN Bund	20 Nov'85	23	"	–	8	27
38.	212660	17 Oct'85	22	MN Bund	27 Nov'85	26	Neduntheevu	–	1	12
39.	203373	1 Mar '85	–	Pump House-2	27 Nov'85	31	"	–	9	2
40.	214947	19 Jan'85	19	MN Bund	9 Dec'85	20	Mariamman Koil	–	10	24
41.	219975	15 Feb'85	20	Neduntheevu	11 Dec'85	20	MN Bund	–	10	–
42.	224753	6 Dec'85	23	Mariamman Koil	16 Dec'85	26	"	–	–	11
43.	214201	19 Dec'84	23	Mariamman Koil	27 Dec'85	24	MN Bund	1	–	9
44.	226016	14 Dec'85	29	MN Bund	31 Dec'85	22	Mariamman Koil	–	–	18
45.	224872	9 Dec'85	17	Mariamman Koil	31 Dec'85	23	"	–	–	23
46.	224164	15 Nov'85	28.5	"	2 Jan'86	26	"	–	1	19
47.	224186	16 Nov'85	19	"	6 Jan'86	19	"	–	1	22
48.	223718	12 Oct'85	26	MN Bund	6 Jan'86	24	MN Bund	–	2	26
49.	214556	31 Dec'84	20	Pump House-2	6 Jan'86	24	"	–	–	7
50.	224876	9 Dec'85	22	Mariamman Koil	8 Jan'86	22	"	–	1	1
51.	220081	19 Feb'85	24	MN Bund	10 Jan'86	22	"	–	10	26
52.	213037	26 Oct'84	20	"	24 Jan'86	22	"	1	3	1
53.	212162	2 Oct'84	24	"	7 Feb'86	20	Pump house-3	1	3	7
54.	169757	26 Sep'80	22	"	7 Feb'86	24	"	5	4	15
55.	205872	17 Nov'83	24.5	C. Plantation	7 Feb'86	23	"	2	2	24
56.	223712	12 Oct'85	20	MN Bund	7 Feb'86	21	"	–	3	28
57.	223437	28 Sep'85	20	"	11 Feb'86	23	"	–	4	17
58.	211775	17 Sep'84	26	Retta Theevu	11 Feb'86	19	"	1	4	28
59.	205014	22 Oct'83	16	–	12 Feb'86	22	"	2	3	24
60.	209800	6 Oct'83	29	Pump House-2	15 Feb'86	22	N of MN Bund	2	4	13

TABLE 3 (contd.)

No.	Ring No.	Date of ringing	Wt. (g)	Location	Recapture date	Wt. (g)	Location	Time interval		
								years	months	days
61.	226783	25 Jan' 85	19	Pump House-2	15 Feb'86	21	"	–	–	22
62.	223509	20 Sep' 85	19.5	MN Bund	15 Feb'86	20	"	–	4	20
63.	211396	9 Mar '84	24	Kutnikkadu	19 Feb'86	22.5	"	1	11	19
64.	224933	11 Dec'85	24	MN Bund	19 Feb'86	25	"	–	2	10
65.	230167	15 Feb'86	24	North of MCIC	19 Feb'86	24	"	–	–	5
66.	178008	20 Nov'80	19	Light House	19 Feb'86	23	"	5	3	3
67.	211684	13 Sep'84	23	MN Bund	22 Feb'86	21	North of MCIC	1	5	13
68.	213435	8 Nov'84	21	C.Plantation	22 Feb'86	21	"	1	3	17
69.	223622	10 Oct'85	21	MN Bund	22 Feb'86	21.5	"	–	4	16
70.	226341	28 Dec'85	23	MN Bund	22 Feb'86	19.5	"	–	1	27
71.	230417	24 Feb'86	21	North of MCIC	4 Mar' 86	21	MN Bund	–	–	9
72.	230571	25 Feb'86	27	"	5 Mar '86	25	"	–	–	9
73.	230720	5 Mar '86	20	"	8 Mar '86	19	"	–	–	4
74.	230392	22 Feb'86	23	"	8 Mar '86	20	"	–	–	15
75.	223718	12 Oct '85	26	MN Bund	8 Mar '86	21	"	–	4	28
76.	230459	24 Feb'86	27	North of MCIC	15 Mar '86	24	"	–	–	20
77.	230294	18 Feb'86	20	North of MN Bund	15 Mar '86	21	"	–	–	26
78.	197129	3 Sep'82	21	Pump House-2	24 Mar '8	25	"	3	6	24
79.	207529	7 Mar '83	23	Pump House-1	25 Mar '86	22	"	3	–	20
80.	230068	11 Feb'86	19	Pump House-3	31 Mar '86	22	"	–	1	19
81.	230818	7 Mar '86	19.5	North of MCIC	31 Mar '86	23	"	–	–	25
82	214541	31 Dec'84	22	"	1 Apr '86	21	"	1	3	2
83.	230876	8 Mar '86	20	"	2 Apr '86	22	"	–	–	26
84.	223336	21 Sep'86	22.5	MN Bund	2 Apr '86	29.5	"	–	6	14
85.	230856	8 Mar '86	22	North of MCIC	4 Apr '86	30	"	–	–	28
86.	213677	14 Nov'84	18	C.Plantation	5 Apr '86	19	"	1	4	23
87.	181898	7 Feb'81	21	Neduntheevu	5 Apr '86	26	MN Bund	5	1	29
88.	193108	24 Nov'81	20	MN Bund	8 Apr '86	21	MN Bund	4	4	17
89.	205316	30 Oct'83	20	Neduntheevu	8 Apr '86	–	"	2	5	12
90.	230912	13 Mar'86	20	North of MCIC	8 Apr '86	20.5	"	–	–	27
91.	216736	4 Apr '86	22	MN Bund	11 Apr '86	25	"	–	–	8

TABLE 3 (contd.)

No.	Ring No.	Date of ringing	Wt. (g)	Location	Recapture date	Wt. (g)	Location	Time interval		
								years	months	days
Calidris ferruginea- AB (Ring size)										
1.	119366	21 Mar '85	53	Kutnikkadu	11 Oct'85	44	MN Bund	–	6	25
2.	108335	25 Sep'84	60	Kutnikkadu	14 Oct'85	45	MN Bund	1	–	20
3.	106582	26 Aug'83	54	Pump House-2	24 Oct'85	49	"	2	2	1
4.	102865	23 Feb'83	52	Pump House-2	31 Oct'85	45	C. P lantation	2	8	12
5.	119130	6 Feb '85	60	North of PH-2	12 Dec '85	56	MN Bund	–	10	10
6.	119561	29 Sep'85	54	MN Bund	21 Mar '86	67	MN Bund	–	5	24
Philomachus pugnax - B (Ring size)										
1.	36763	6 Jan '83	82	Kutnikadu	16 Dec '85	96	MN Bund	2	11	16
2.	35763	24 Nov '81	90	MN Bund	17 Dec '85	107	MN Bund	4	–	25
Charadrius mongolus - AB (Ring size)										
1.	112141	30 Nov '83	63	C. Plantation	16 Nov '85	–	Mariamman Koil	1	11	23
2.	119678	20 Nov '85	46	Pump House -1	22 Nov '85	47	Mariamman Koil	–	–	3
3.	113802	17 Oct '83	42	Neduntheevu	10 Apr '86	43	MN Bund	2	5	27
Tringa totanus - B (Ring size)										
1.	48769	17 Mar '85	140	Kutnikadu	15 Nov '85	105	Mariamman Koil	–	8	4
2.	36799	21 Jan '83	93	Kutnikadu	2 Jan '86	109	Mariamman koil	2	11	18

C. Plantation = Casuarina plantation, PH-2 =Pump House 2, MCIC = Mettur Chemical and Industrial Corporation Ltd.

Alma-Ata region, Kazakhstan, U.S.S.R (43°46' N, 76°05' E). The ring was recovered after 1285 days (3 years, 6 months, 10 days) at Pt. Calimere.

Morphometry: The biometrics of eight species were studied (Table 4). During the ringing sessions measurements such as wing length, bill length, tarsus and tail length were taken. In species with small samples, all the measurements were used for analysis, whereas in the case of larger samples such as *Calidris minuta*, 100 samples each from adult and juvenile birds were used. Minimum and maximum measurements of wing, bill, tarsus and tail were recorded for each species for both juveniles and adults.

An attempt was made to correlate the wing/tarsus ratio to determine racial variation, as in the case of *Charadrius mongolus*, where adults with wing/tarsus ratio below 4.09 are believed to belong to the *atrifrons* group (Cramp and Simmons 1982). The analysis of wing/tarsus ratio of *Charadrius mongolus* indicates that the majority visiting Pt. Calimere fall under the *atrifrons* group (wing/tarsus ratio = 4.01). However, individual analysis of wing/tarsus ratio and plumage characters suggests the possible occurrence of four subspecies of *Charadrius mongolus* at Pt. Calimere (Balachandran and Natarajan 1992).

Seasonality, Diversity and Density of Waterbirds

Methodology

A one kilometre long reservoir with a bund starting and running west from Pump House No.2 (owned by Mettur Chemical and Industrial Corporation) (now Chemplast) was selected for censusing waterbirds. On either side of the bund large condensers filled with salt water provide feeding and roosting areas for many waterbirds. The right side reservoir is active and the water level is maintained constant, whereas in the left reservoir the water level fluctuates widely. Half the left reservoir has been abandoned and dries up completely during summer.

Birds were censused using the fixed-width transect method (Emlen 1971). The birds observed within 200 m on either side of the transect were counted using binoculars and telescope. The bird census was carried out during the morning on alternate days. The bird density (D) was calculated as D = n/2LW, where n is the number of observations within the strip of width W and transect length L (Franzreb 1981). Bird species diversity (H) was calculated using the formula

$$H = -\sum_{i=1}^{n} p_i \ln p_i$$

where p_i is the proportion of individuals in the 'ith' category (MacArthur *et al.* 1966).

Results and Discussion

49 species of birds belonging to six orders were recorded during the census operation, including nine species of landbirds frequently sighted in the study area. The species richness (number of species recorded) varied during different months, with the maximum in September-October 1985 and the minimum in June 1986 (Table 5).

Seasonal Population Fluctuation

The little egret *Egretta garzetta* and painted stork *Mycteria leucocephala* were present throughout the year. Terns, such as the Caspian tern *Hydroprogne caspia*, whiskered tern *Chlidonias hybrida*, and little tern *Sterna albifrons* were also regularly present in the area. There were only a few sightings of species like lesser flamingo *Phoeniconaias minor*, and certain species of ducks. Monthly averages of the birds censused are given in Table 6.

Spotted-billed pelican *Pelecanus philippensis:* The pelicans arrive during September. Their number increases progressively, reaching a peak in December, then suddenly decreases in January, reaching a minimum level in February and March. The birds disappear thereafter. The main reason for the constant increase from October onwards is the stopping of pumping activity by the chemical company and the rainfall, which lowers salinity in the reservoir and presumably thereby increases the fish population, providing enough food for the birds.

Grey heron *Ardea cinerea:* A small resident population was recorded almost throughout the

TABLE 4
MEASUREMENTS OF EIGHT SPECIES OF BIRDS RINGED AT PT. CALIMERE

	Sample size	Range	Mean
	Charadrius mongolus		
Wing (mm)	10 A	123-131	126.3
	11 J	118-130	123.9
Bill (mm)	17 A	17-20	18.8
	12 J	16.5-20.5	18.6
Tarsus (mm)	16 A	28-35	31.5
	14 J	28-35	31.3
Tai (mm)	15 A	50-54	51.1
	12 J	42-51	46.5
Weight (g)	17 A	42-54	47.4
	14 J	40-54	47.6
Adult wing / tarsus ratio = 4.01			
	Tringa totanus		
Wing (mm)	8 A	149-163	157.9
Bill (mm)	8 A	41-46	43.5
Tarsus (mm)	8 A	42-51	47.1
Tail (mm)	8 A	58-68	64.3
Weight (g)	8 A	90-140	116.4
	Tringa stagnatilis		
Wing (mm)	20 A	131-152	139.4
	8 J	136-142	139.5
Bill (mm)	20 A	37-45	40.8
	8 J	39-46	43.1
Tarsus (mm):	20 A	44-59	50.8
	7 J	48-58.5	53.9
Tail (mm):	20 A	53-66	59.4
	7 J	55-61	58.7
Weight (g):	20 A	48-82	59.7
	8 J	71-84	75
	Calidris minuta		
Wing (mm)	96 A	92-107	97.3
	100 J	92-103	98.1
Bill (mm)	99 A	16-21	18.9
	100 J	16-20	18.9
Tarsus (mm)	99 A	18-23	20.4
	100 J	18-22	20.3
Tail (mm)	99 A	33-44	40.2
	99 J	36-42	39.9
Weight (g)	99 A	19-28	22.5
	100 J	18-27.5	21.4

A – adult, J – Juvenile (first year bird)

	Sample size	Range	Mean
	Calidris ferruginea		
Wing (mm)	43 A	123-138	130.3
	50 J	124-135	129.7
Bill (mm)	77 A	31-45	38.3
	50 J	27-42	37.3
Tarsus (mm)	76 A	26-33	29.3
	48 J	24-32	29.2
Tail (mm)	70 A	42-53	48
	44 J	41-49	45.7
Weight (g)	80 A	44-62	52.2
	50 J	44-84	54.4
	Calidris alpina		
Wing (mm)	3 A	115-123	120.3
	12 J	115-123	119.4
Bill (mm)	3 A	31-35	33.7
	13 J	30-38	33.3
Tarsus(mm)	3 A	22-25	23.7
	13 J	21-26.5	24
Tail (mm)	3 A	47-54	51
	11 J	46-53	50
Weight (g)	3 A	43-48	45.7
	12 J	39-54	46.2
	Limicola falcinellus		
Wing (mm)	8 A	107-111	107.3
Bill(mm)	11 A	30-34	31.6
Tarsus(mm)	11 A	20-23	20.5
Tail (mm)	11 A	37-42	39.6
Weight (g)	11 A	24-34	30.1
	Philomachus pugnax, female		
Wing (mm)	38 A	150-167	156.4
	19 J	150-163	157.3
Bill (mm)	52 A	27.5-32	30.3
	16 J	28-32	30.1
Tarsus (mm)	53 A	35-44	39.2
	16 J	35-42	38.8
Tail (mm)	53 A	52-71	57.5
	18 J	54-60	57.3
Weight (g)	57 A	80-116	102.8
	19 J	91-114	105.3
	Philomachus pugnax, male		
Wing (mm)	3 A	186-189	187.3
Bill (mm)	9 A	31-38	35.6
Tarsus (mm)	9 A	45-50	48.2
Tail (mm)	9 A	67-72	69.6
Weight (g)	9 A	148-187	169.9

census studies. There was no peak or fall worth noting. Breeding in some islets in the swamp.

Little egret *Egretta garzetta:* Recorded throughout the census period. Two main peaks, in August and April, were observed, followed by a slight peak in June. The population was very low during October-November.

Indian reef heron *Egretta gularis:* A seasonal migrant, recorded only from October to May.

Redshank *Tringa totanus:* This migrant was seen from August to November, then reappeared after a break of two months. A peak was observed in February and was seen up to March. Thereafter in April, May and June it was not recorded.

Greenshank *Tringa nebularia:* Trends similar to those for the redshank, except for its absence from May to July.

Little stint *Calidris minuta:* The commonest species at Pt. Calimere, but present in small numbers from August till December. A sudden increase in January and decline in February, with a slow increase through March, reaching a second peak in April. The species was absent from May to July.

Curlew sandpiper *Calidris ferruginea:* Occurred in almost all months except February, May and June. The maximum population was recorded during October and a very high congregation was seen during July. Interestingly, there was a high population in April, followed by a complete absence during May and June and again a very high peak in July.

Herring gull *Larus argentatus:* The first among the gulls to reach Pt. Calimere, but was not common in the census area. A small population was noticed during September, October and January. They preferred the sea shore as it provided large amounts of fishery waste on which they fed.

Brownheaded gull *Larus brunnicephalus:* The commonest gull in the swamps of Pt. Calimere, noted from October till May, reaching a peak during January. A sudden decline in February, followed by a second peak in March and then a decline in May.

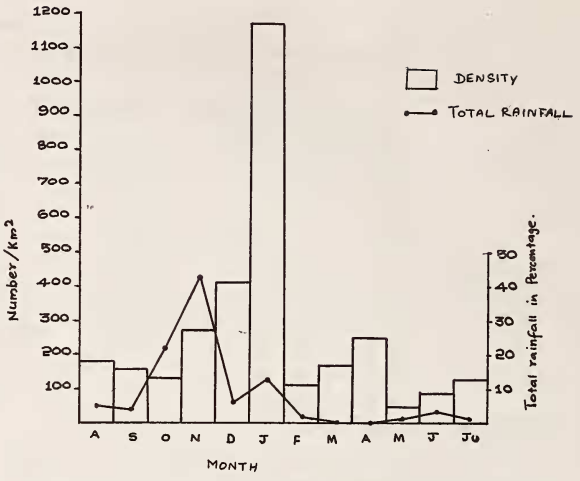

Fig. 1. Monthly variation in density of waterbirds during 1985-86 at Pt. Calimere

Whiskered tern Chklidonias hybrida: Fairly comon in the swamp habitat, usually present throughout the year.

Common tern *Sterna hirundo:* Recorded throughout the census period with a peak in August, thereafter showing a constant decline, reaching a minimum in October.

Little tern *Sterna albifrons:* A breeding resident of Pt. Calimere, present throughout the year with slight variations in numbers every month.

Swallow *Hirundo rustica:* Even though they are landbirds they prefer swamp habitat for both feeding and roosting. First recorded in September

TABLE 5
BIRD SPECIES DIVERSITY AND SPECIES RICHNESS

Month	Bird species diversity	No. of species
August 1985	2.03	19
September	2.40	29
October	2.04	29
November	1.85	25
December	2.16	22
January 1986	1.59	26
February	2.04	23
March	1.88	24
April	2.01	27
May	2.34	22
June	1.87	13
July	1.94	20

TABLE 6
MONTHLY AVERAGES OF WATERBIRDS CENSUSED IN 1985-'86

Species	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
Pelecanus philippensis	–	2.8	4.8	11.6	16.6	1.9	P	P	–	–	–	–
Ardea cinerea	2.7	–	P	–	2.7	P	P	1.8	2..6	P	3.5	2.1
Ardeola grayii	P	–	P	P	5	2.1	2.9	5.3	8.5	2.4	–	–
Ardea alba	P	–	–	2.1	2.8	1.9	4.1	1.7	2	–	–	–
Egretta intermedia	–	P	P	–	–	–	–	–	P	P	–	–
Egretta garzetta	23.1	13.5	3.4	1.6	6.2	5.5	13.0	13.8	27.5	5.1	14	5.3
Egretta gularis	–	–	P	P	2.7	1.2	2.6	4.6	2.8	P	–	–
Mycteria leucocephala	23.9	10.3	8.3	2.8	9.3	2.5	P	P	10.0	3.5	14.8	25.1
Platalea leucorodia	–	–	2.6	3.4	–	–	–	–	–	–	–	–
Phoenicopterus roseus	–	24.8	1	21.8	–	199.2	–	–	–	–	–	–
Phoeniconaias minor	–	–	–	–	–	–	–	–	–	P	–	–
Anas acuta	–	–	–	–	–	388.5	–	–	–	–	–	–
Anas poecilorhyncha	–	–	–	–	–	–	–	–	–	–	–	P
Anas clypeata	–	–	–	–		109.2						
Himantopus himantopus	–	–	–	–	89.9	–	–	–	–	P	–	–
Recurvirostra avosetta	–	–	–	41.8	–	–	–	–	–	–	9	23.5
Pluvialis squatarola	P	–	P	–	–	–	–	–	–	–	–	–
Charadrius dubius	–	P	–	P	–	–	–	–	–	–	–	–
Charadrius alexandrinus	P	P	1.2	–	–	–	P	P	P	–	–	–
Charadrius mongolus	1.1	1.4	2.1	–	–	–	–	–	–	–	–	–
Numenius phaeopus	–	P	–	–	–	–	–	–	–	–	–	–
Tringa totanus	P	P	P	P	–	–	1.2	P	–	–	–	1.4
Tringa stagnatilis	–	P	P	–	40.4	4.6	2.2	1.1	P	P	–	P
Tringa nebularia	P	P	P	–	–	–	P	P	P	–	–	–
Tringa terek	1	P	–	–	–	–	P	–	2.1	P	–	–
Tringa hypoleucos	–	–	–	–	–	–	P	–	P	–	–	P
Arenaria interpres	–	–	–	–	–	–	–	–	P	P	–	–
Calidris minuta	46.7	28.2	47.6	4	38.8	171.2	31.6	55.3	90.5	45	–	P

TABLE 6 (contd.)

Species	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
Calidris ferruginea	10.9	8	11.4	P	P	P	–	1.7	14.3	–	–	29.1
Philomachus pugnax	–	P	–	–	15.5	–	–	–	–	–	–	–
Phalaropus lobatus	–	–	–	–	–	–	P	–	–	–	–	–
Larus argentatus	–	P	P	–	–	P	–	–	–	–	–	–
Larus fuscus	–	–	–	P	–	–	–	–	–	–	–	–
Larus brunnicephalus	–	–	P	P	4.9	36.2	16.2	31.3	18.2	1.8	–	–
Larus ridibundus -	–	–	–	1.4	–	–	–	–	–	–	–	–
Chlidonias hybrida	5.3	6.5	6.2	P	–	P	5.1	8.5	2.9	P	P	P
Gelochelidon nilotica	9.9	1.8	P	P	1.2	P	P	P	P	–	P	–
Hydroprogne caspia	3.4	8.7	6.2	1.7	1.6	P	P	P	1	10.1	20	10
Sterna hirundo	11.3	8.6	P	P	2.2	1.5	P	P	P	P	P	P
Sterna albifrons	P	2.8	1.6	2.8	2.2	1.7	P	P	2.8	P	1.5	3.9
Landbirds												
Haliastur indus	–	4.7	1.9	3	2.5	3.4	3.1	2.6	4.5	2.3	2.5	4.0
Cypsiurus parvus	–	–	–	12.5	7.2	–	–	P	–	–	P	P
Ceryle rudis	–	P	P	–	–	–	–	P	–	P	P	P
Alcedo atthis	–	P	P	P	P	–	–	–	P	–	–	P
Halcyon smyrnensis	–	–	–	–	P	P	–	–	P	P	–	P
Hirundo rustica	–	–	–	98.2	72.5	P	–	–	–	–	–	–
Corvus splendens	–	P	P	–	–	3.7	P	P	3.8	1.8	1.3	1.4
Corvus macrorhynchos	P	P	–	–	–	P	–	–	P	–	–	–
Motacilla maderaspatensis	–	P	P	–	–	P	P	P	P	–	–	–

P = Mean of less than 1

TABLE 7
POPULATION DENSITY OF WATERBIRDS AT PT. CALIMERE (AUGUST 1985 – JULY 1986)

Species	Status	Density/ sq. km
Pelecanus philippensis	SM	8
Ardea cinerea	R	4
Ardeola grayii	C	6
Ardea alba	C	3
Dgretta intermedia	C	1
Egretta garzetta	C	28
Egretta gularis	C	3
Mycteria leucocephala	C	23
Platalea leucorodia	SM	1
Phoenicopterus roseus	SM	52
Phoeniconaias minor	SM	1
Anas acuta	M	81
Anas poecilorhyncha	SM	1
Anas clypeata	M	23
Himantopus himantopus	SM	19
Recurvirostra avosetta	M	16
Pluvialis squatarola	M, C	1
Charadrius dubius	C, R	1
Charadrius alexandrinus	C, R	1
Charadrius mongolus	M, C	1
Numenius phaeopus	M, C	1
Tringa totanus	M, C	1
Tringa stagnatilis	M, C	10
Tringa nebularia	M, C	1
Tringa terek	*M*	*1*
Tringa hypoleucos	M, C	1
Arenaria interpres	M, C	1
Calidris minuta	M, C	108
Calidris ferruginea	M, C	16
Philomachus pugnax	M, C	3
Phalaropus lobatus	M, O	1
Larus argentatus	M, C	1
Larus fuscus	M, C	1
Larus brunnicephalus	M, C	23
Larus ridibundus	M, C	1
Chlidonias hybrida	M, C	8
Gelochelidon nilotica	M, C	3
Hydroprogne caspia	M, C	13
Sterna hirundo	M, C	6
Sterna albifrons	R, B	4

B = breeding, C = common, R = resident, M = migrant, SM = seasonal migrant, O = occasional.

but completely absent in October. A large influx was noted during November; the population remained stable throughout December and decreased in January, after which they disappeared from the area. Three interesting recoveries were obtained during 1986: birds ringed at Mootpuzha in Kerala were captured by false vampire bats in Tamil Nadu during November, suggesting an eastward movement of this species during migration (Sugathan 1988).

Brahminy kite *Haliastur indus:* There was not much variation in population size, which remained almost constant throughout the year except during August. A breeding resident, commonly seen in good numbers on the seashore from November to February (the fishing season). Feeds on fishery waste, along with gulls.

Bird species diversity: The mean monthly bird species diversity was 2.01. The monthly variation of the diversity is shown in Table 5.

Density of waterbirds: The status and density of waterbirds estimated per sq. km are given in Table 7. Monthly variations in density are shown in Fig. 1. The annual mean bird density (all species) was 516 birds/sq. km. The density was highest in January, lowest in May and increased after the rains (Fig. 1).

The census data was gathered mainly from reservoirs (man-made habitat), which attract large numbers of piscivorous birds rather than waders. The figures for natural habitat may be significantly different.

ACKNOWLEDGEMENTS

I am grateful to J.C. Daniel, S.A. Hussain and R. Sugathan of BNHS for their help and encouragement during the study. I am also thankful for financial assistance from the U S. Fish and Wildlife Service, received through the Ministry of Environment, Govt. of India. Lastly, I want to thank all the Forest Department officials at Pt. Calimere Wildlife and Bird Sanctuary, for their co-operation and help.

References

Ali, S. (1963): Pt. Calimere as a refuge for wintering shore birds. *J. Bombay nat. Hist. Soc. 60:* 458-460.

Ali, S. & Hussain, S.A. (1981-1982): Studies on the movement and population structure of Indian Avifauna. Annual Report Nos. I & II. Bombay Natural History Society, Bombay.

Balachandran, S. & Natarajan, V. (1992): Possible occurrence of four subspecies of lesser sand plover *Charadrius mongolus* at Pt. Calimere Wildlife Sanctuary, Tamil Nadu. *J. Bombay nat Hist. Soc. 89(1):* 118-119.

Cramp, S. & Simmons, K.E.L. (eds.) (1982): The Birds of the Western Palaearctic, Vol.III. Oxford University Press, Oxford.

Emlen, J.T. (1971): Population densities of birds derived from transect counts. *Auk 88:* 323-342.

Franzreb, K.E. (1981): The determination of avian densities using the variable strip and fixed-width transect surveying methods. *In:* Ralph, C.J and Scott, J.M (eds.),Estimating numbers of territorial birds. Stud. Avian Biol. No. 6. pp. 139- 145.

MacArthur, R., Recher, H. & Cody, M. (1966): On the relation between habitat selection and species diversity. *Am. Nat. 100:* 319-325.

Prater, A.J., Marchant, H.J., & Vuorinen, J. (1977): Guide to the identification and ageing of Holarctic Waders. BTO Field Guide. 17.

Spencer, R. (1976): The Ringer's Manual BTO, Tring.

Sugathan, R. (1982): Some interesting aspects of the Avifauna of the Pt. Calimere Sanctuary, Thanjavur district, Tamil Nadu. *J. Bombay nat. Hist. Soc. 79(3):* 567-575.

Sugathan, R. (1988): Movement of the Eastern Swallow (*Hirundo rustica gutturalis*) ringed at Mootpuzha, Kerala. *J. Bombay nat. Hist. Soc. 85(2):* 428-429.